

(12) PATENT APPLICATION
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. AU 199889488 A1

(54) Title
Methods and apparatus for originating voice calls

(51)⁵ International Patent Classification(s)
H04M 003/50 H04Q 003/00
H04M 003/48

(21) Application No: 199889488 (22) Application Date: 1998.10.23

(30) Priority Data

(31) Number	(32) Date	(33) Country
004603	1995.09.29	US
652659	1996.05.28	US

(43) Publication Date : 1999.01.14
(43) Publication Journal Date : 1999.01.14

(62) Divisional of:
199667295

(71) Applicant(s)
Nortel Networks Corporation

(72) Inventor(s)
Cecil H. Bannister; Russell A. Edwards; Rangaprasad Govindarajan

(74) Agent/Attorney
GRIFFITH HACK, GPO Box 1285K, MELBOURNE VIC 3001



AU9889488

(12) PATENT ABSTRACT (11) Document No. AU-A-89488/98
(19) AUSTRALIAN PATENT OFFICE

- (54) Title
METHODS AND APPARATUS FOR ORIGINATING VOICE CALLS
- (51)⁵ International Patent Classification(s)
H04M 003/50 H04M 003/48 H04Q 003/00
- (21) Application No. : 89488/98 (22) Application Date : 23/10/98
- (30) Priority Data
- | | | |
|-------------|-----------|-----------------------------|
| (31) Number | (32) Date | (33) Country |
| 004603 | 28/09/95 | US UNITED STATES OF AMERICA |
| 652659 | 28/05/96 | US UNITED STATES OF AMERICA |
- (43) Publication Date : 14/01/99
- (62) Related to Division(s) : 67295/96
- (71) Applicant(s)
NORTHERN TELECOM LIMITED
- (72) Inventor(s)
CECIL H. BANNISTER; RUSSELL A. EDWARDS; RANGAPRASAD GOVINDARAJAN
- (74) Attorney or Agent
GRIFFITH HACK, GPO Box 1285K, MELBOURNE VIC 3001
- (57)

A method for originating a voice call between a first voice terminal (110, 420) to be used by a voice call requestor and a second voice terminal (120, 510, 520, 530, 610, 620, 630) to be used by a party to which the call requestor wishes to be connected, the method including:

 sending a voice call request from a data terminal (100, 400) to a data service node (500, 600);

 transmitting a call origination request from the data service node to a telecommunications switch (510, 610, 710);

 originating at the telecommunications switch one call from the telecommunications switch to the second voice terminal and another call from the telecommunications switch to the first voice terminal; and

 connecting the one call to the other call at the telecommunications switch to connect the first voice terminal to the second voice terminal

 characterized in that:

 the voice call request identifies the first voice terminal; and

 the call origination request identifies the first and second voice terminals.

ABSTRACT

A method for originating a voice call between a first voice terminal (110, 420) to be used by a voice call requestor and a second voice terminal (120, 510, 520, 530, 610, 620, 630) to be used by a party to which the call requestor wishes to be connected, the method including:

5 sending a voice call request from a data terminal (100, 400) to a data service node (500, 600);
10 transmitting a call origination request from the data service node to a telecommunications switch (510, 610, 710);

originating at the telecommunications switch one call from the telecommunications switch to the second voice terminal and another call from the telecommunications switch to the first voice terminal; and

15 connecting the one call to the other call at the telecommunications switch to connect the first voice terminal to the second voice terminal

20 characterized in that:

the voice call request identifies the first voice terminal; and

the call origination request identifies the first and second voice terminals.

25

AUSTRALIA
Patents Act 1990

PATENT REQUEST : STANDARD PATENT

We, being the person identified below as the Applicant, request the grant of a Standard Patent to the person(s) identified below as the Nominated Person, for an invention described in the accompanying complete specification.

**Applicant and
Nominated Person:** NORTHERN TELECOM LIMITED

Address: WORLD TRADE CENTRE OF MONTREAL
380 ST. ANTOINE STREET WEST
8TH FLOOR
MONTREAL QUEBEC H2Y 3Y4
CANADA

Invention Title: METHODS AND APPARATUS FOR ORIGINATING VOICE
CALLS

**Names of Actual
Inventors:** Cecil H BANNISTER; Rangaprasad GOVINDARAJAN
Russell A EDWARDS

Address for Service: GRIFFITH HACK
509 ST KILDA ROAD
MELBOURNE VIC 3004

Attorney Code: HA

DIVISIONAL APPLICATION DETAILS

Application No.: 67295/96

Drawing number recommended to accompany the abstract: 2

DATED: 23 October 1998

NORTHERN TELECOM LIMITED

GRIFFITH HACK
MELBOURNE OFFICE



C. M. BENTLEY

Patent Attorney for and
on behalf of the Applicant

M105965 23 OCT98

AUSTRALIA
Patents Act 1990

COMPLETE SPECIFICATION
STANDARD PATENT

Applicant(s):

NORTHERN TELECOM LIMITED

Invention Title:

METHODS AND APPARATUS FOR ORIGINATING VOICE CALLS

The following statement is a full description of this
invention, including the best method of performing it known to
me/us:

METHODS AND APPARATUS FOR ORIGINATING VOICE CALLS

Field of Invention

5 This invention relates generally to methods and apparatus for originating voice calls, and more particularly to methods and apparatus for originating voice calls using a data terminal connected to a data service node.

10 Background of Invention

Today, many businesses are aggressively participating in the information highway phenomenon by advertising their goods and services on World Wide Web home pages that are accessible to the general public via the Internet data network. The number of businesses advertising on the World Wide Web is exploding.

However, as businesses gain experience with advertising on the World Wide Web, they recognize that their home pages may not efficiently provide the information required by each individual customer or effectively sell their product or service to each individual customer. Many customers may browse their home pages on the World Wide Web, but may not take the time to investigate further to answer any remaining questions they may have, and the advertisers may miss business opportunities as a result.

To encourage customers to investigate further, and to provide the opportunity to sell directly to the customer, many advertisers provide a 1-800 number on their home pages and suggest that potential customers call for further information.

35 However, in order to route customer calls made to the 1-800 number to a specialist who can answer the particular customer's questions, the advertiser must use a

human attendant or an interactive voice response system to route the calls based on the information desired by the customer. Customers who use the World Wide Web to find product and service information want to obtain that information quickly and with a minimum effort. Such customers consider the process of working through human attendants and interactive voice response systems to find the person who can answer their questions to be unacceptably time-consuming and tedious, especially when they are put on hold waiting for that person to become available. Consequently, many such customers will not call 1-800 numbers to obtain further information, and the advertiser misses an opportunity to sell directly to the individual customer.

World Wide Web advertisers could overcome this problem by providing several distinct 1-800 numbers on their information pages and indicating clearly that each 1-800 number will connect callers directly to someone who can deal with their specific questions. However, the requirement for several distinct 1-800 numbers would increase the advertiser's telecommunications costs considerably and would not assure the caller that someone will be available to answer their questions immediately when they call.

Today, telephone operating companies provide printed telephone directories including "yellow pages" which provide entries for businesses grouped according to the products or services provided by the businesses. Users of the "yellow pages" locate the product or service category of interest in the "yellow pages", select a business based on its entry in the "yellow pages", and dial the telephone number listed in the entry for that business. The user may make errors dialing the listed number. Moreover, even when the user dials correctly, the call may be unanswered, or may be connected to an interactive voice

response system or a human attendant for further routing. As noted above, many users dislike working through interactive voice response systems and human attendants.

5 Today, the tariffs charged by a telephone operating company in a first country for placing a voice call to a second country may be significantly greater than the tariffs charged by a telephone operating company in the second country for placing a voice call from the second
10 country to the first country. For example, the voice tariffs charged by a Japanese telephone operating company for placing a call from a first directory number in Japan to a second directory number in the US are considerably higher than the rates charged by a US telephone operating
15 company for placing a call from the second directory number in the US to the first directory number in Japan. US service providers capitalize on this discrepancy by offering services by which a Japanese caller can call a US service provider and request a connection between the first
20 directory number in Japan and the second directory number in the US. The US service provider then places a first call to the second directory number in the US, a second call to first directory number in Japan and connects the first and second calls to provide the desired connection.
25 Because the connection is made from the US to Japan, the Japanese caller can be charged at a rate based on the lower tariffs charged by a US telephone operating company. However, the Japanese caller must also pay the cost of the short call from Japan to the US service provider required
30 to set up the desired call.

French Patent Document 2,677,517 describes a system in which a videotext terminal is placed in the lobby of a business building alongside a telephone. The
35 videotext terminal is connected to a server which is connected to a telecommunications switch. The server displays a menu of people or departments with whom a

visitor may want to make contact. The visitor selects a person or department on the videotext terminal, and the server automatically causes the telecommunications switch to set up a call between the telephone of requested party and the telephone alongside the videotext terminal. The described system is confined to a single building, and has only one videotext terminal and telephone for use by a call requestor.

10 Summary of Invention

- An object of this invention is to provide methods and apparatus for originating voice calls between voice terminals using a data terminal and a data service node without requiring interaction with human attendants or interactive voice response systems to complete the call.

One aspect of the invention provides a method for originating a voice call between a first voice terminal to be used by a voice call requestor and a second voice terminal to be used by a party to which the call requestor wishes to be connected, the method comprising: sending a voice call request from a data terminal to a data service node; transmitting a call origination request from the data service node to a telecommunications switch; originating at the telecommunications switch one call from the telecommunications switch to the second voice terminal and another call from the telecommunications switch to the first voice terminal; and connecting the one call to the other call at the telecommunications switch to connect the first voice terminal to the second voice terminal, characterized in that: the voice call request identifies the first voice terminal; and the call origination request identifies the first and second voice terminals.

35 The data service node may display a command menu (for example a plurality of command icons) at the data terminal. In this case, the command menu comprises a voice

call request command (for example a voice call request icon), and the data service node interprets selection of the voice call request command as a voice call request. The voice call request icon may comprise a data entry field and may indicate that the first voice terminal identifier is to be entered into the data entry field before selecting the voice call request icon. Alternatively, the data terminal may be operable in response to selection of the voice call request icon to read the first voice terminal identifier from a mail profile of the data terminal and to transmit the first voice terminal identifier to the data service node via the data network. The alternative approach requires additional software at the data terminal, but avoids the need for the operator of the data terminal to type the first voice terminal identifier each time a voice call is requested.

Advantageously, the command menu may comprise plural distinct voice call request commands, and the data service node may respond to distinct voice call request commands by transmitting to the telecommunications switch call origination requests comprising distinct respective second voice terminal identifiers. In this case, different voice call request commands may be executed to obtain different types of information and, in each case the requestor of the voice call will be called by a particular agent who is familiar with the desired information. The voice call request commands displayed may explicitly state the type of information available if the voice call request commands are selected, or the type of information to be provided (and consequently the particular second voice terminal identifier to be included in the voice call origination request) may be inferred by the data service node from the context in which each distinct voice call command request appears in the data displayed at the data terminal.

The telecommunications switch may be programmed to originate the second call only when the first call has been accepted at the second voice terminal. In this case, the data service node may maintain a queue of call

- 5 origination requests at the data service node when the second voice terminal is busy and may transmit from the data service node to the telecommunications switch the next call origination request in the queue each time the second voice terminal becomes idle.

10

- In one application of the above method, the data service node may provide advertising services on the World Wide Web, and the data terminal may be operated by a potential customer accessing the advertising services via the Internet. The first voice terminal may be a telephone of the potential customer, and the second voice terminal may be a telephone of a business advertising by means of the advertising services. The potential customer may request a voice connection with the business by executing a command on the data terminal. The advertising services may be telephone directories or "yellow pages" accessed by the potential customer on the World Wide Web.

- The call origination method described above minimizes the potential customer's inconvenience by automatically having an agent of the advertiser call the customer when that agent is available. Because the voice call is placed from the advertiser's agent to the potential customer, the potential customer is assessed no telecommunications charges. Consequently, the advertiser does not need to buy 1-800 service to avoid telecommunications charges to its potential customers. Because the advertiser does not require 1-800 service, the advertiser may provide several distinct call request commands without incurring a telecommunications cost penalty. Each distinct call request command may be made specific to a particular product line or type of

information, so that the potential customer is assured of being connected to an agent that can provide the information or service required. It is anticipated that the increased convenience to the potential customer provided by this call origination method will enable World Wide Web advertisers to sell directly to at least some of those potential customers who are unwilling to call the 1-800 number presently provided on World Wide Web advertising pages, enabling the advertisers to sell directly to more potential customers.

Some advertisers may operate multiple geographically-spaced data service nodes to serve potential customers over a large geographic area. Such advertisers may want to refer call origination requests to the agents who are located closest to the potential customer. To meet this requirement, the method described above may be extended to accommodate multiple data service nodes such that each data service node can forward voice call requests to other data service nodes. The data service node which receives the voice call request may select another data service node to which the voice call request may be forwarded based on the first voice terminal identifier.

In another application of the method described above, the data service node may be operated by a business offering international calling services, and the data terminal may be operated by an international caller who wishes to avoid high tariffs for placing voice calls from his home country to a foreign country. The international caller may request origination of a call between his telephone and a telephone in a foreign country using his data terminal. The data service node may cause a telecommunications switch in the foreign country to place calls to the voice terminal of the called party in the foreign country and to the voice terminal of the international caller to complete a voice connection by

making only calls originated in the foreign country. No call from the home country to the foreign country is needed to set up the call, and no interaction with interactive voice response or human attendants is needed to set up the
5 call.

Another aspect of the invention provides a data service node for connection to a data network to provide a data service, the data service node comprising: means for
10 receiving from a data terminal connected to the data network a voice call request; and means for transmitting to a telecommunications switch a call origination request; characterized in that: the means for receiving a voice call request is operable to read a first voice terminal
15 identifier in the voice call request, the first voice terminal identifier identifying a first voice terminal to be used by a voice call requestor; and the means for transmitting a call origination request is operable to encode the first voice terminal identifier and a second
20 voice terminal identifier in the call origination request, the second voice terminal identifier identifying a second voice terminal to be used by a party to which the call requestor wishes to be connected.

Another aspect of the invention provides a data service system, comprising: a data service node for connection to a data network to provide a data service, the data service node comprising: means for receiving from a data terminal connected to the data network a voice call
30 request; and means for transmitting to a telecommunications switch a call origination request; and a telecommunications switch connected to the data service node, the telecommunications switch comprising: means for originating one call from the telecommunications switch to
35 a first voice terminal to be used by a voice call requestor and another call from the telecommunications switch to a second voice terminal to be used by a party to which the

call requestor wishes to be connected; and means for connecting the one call to the other call to connect the first voice terminal to the second voice terminal characterized in that: the means for receiving a voice
5 call request is operable to read a first voice terminal identifier in the voice call request, the first voice terminal identifier identifying the first voice terminal; and the means for transmitting a call origination request is operable to encode the first voice terminal identifier
10 and a second voice terminal identifier in the call origination request, the second voice terminal identifier identifying the second voice terminal.

The data service system may comprise a plurality
15 of data service nodes and a plurality of telecommunications switches, each data service node being connected to a respective telecommunications switch and being operable to forward voice call requests to others of the data service nodes. The data service nodes may select other data
20 service nodes for the forwarding of voice call requests based on the first voice terminal identifiers.

25

30

35

Brief Description of Drawings

Embodiments of the invention are described below by way of example only. Reference is made to accompanying drawings in which:

5 Figure 1 is a block schematic diagram showing interconnected telecommunications networks incorporating one embodiment of the invention;

 Figure 2 is an information flow diagram summarizing information flows in the interconnected
10 networks of Figure 1 as required to generate and execute a voice call request; and

 Figure 3 is a flow chart illustrating steps in a first task performed by a data service node of the telecommunications networks of Figure 1 to process a voice
15 call request;

 Figure 4 is a flow chart illustrating steps in a second task performed by a data service node of the telecommunications networks of Figure 1 to process a voice call request;

20 Figure 5 is a block schematic diagram showing interconnected telecommunications networks incorporating another embodiment of the invention;

 Figure 6 is a block schematic diagram showing interconnected telecommunications networks incorporating
25 another embodiment of the invention;

 Figure 7 is an information flow diagram summarizing information flows in the interconnected networks of Figure 6 as required to generate and execute a voice call request;

30 Figure 8 is a block schematic diagram showing interconnected telecommunications networks incorporating another embodiment of the invention; and

 Figure 9 is a block schematic diagram showing interconnected telecommunications networks incorporating
35 another embodiment of the invention.

Detailed Description

Figure 1 is a block schematic diagram showing interconnected telecommunications networks incorporating an embodiment of the invention.

5

A data terminal in the form of a first workstation 100 comprises a processor 101, a memory 102 storing instructions for execution by the processor 101, a keyboard 103 for providing manual inputs to the processor 101 and a display 104 for displaying data to an operator of the workstation 100. The workstation 100 further comprises a modem 106 for formatting data for transmission over the Public Switched Telephone Network (PSTN) 200.

15

A voice terminal in the form of a telephone 110 is located near the workstation 100 and is intended for the use of the operator of the workstation 100. The telephone 110 is also connected to the PSTN 200.

20

For example, the workstation 100 and the telephone 110 may be located in the operator's home. The operator may use the workstation 100 to obtain access to a data network in the form of the Internet 300 via the PSTN 200. A modem pool 302 links the PSTN 200 to the Internet 300 for this purpose. The memory 102 of the workstation 100 contains "browser software" (for example Netscape™), which the operator may use to "navigate" among various data services provided via the Internet 300.

25

30

Another data terminal in the form of a second workstation 400 comprises a processor 401, a memory 402 storing instructions for execution by the processor 401, a keyboard 403 for providing manual inputs to the processor 401 and a display 404 for displaying data to an operator of the workstation 400. The workstation 400 further comprises a LAN interface 406 for formatting data for transmission over a Local Area Network 410.

35

A voice terminal in the form of a telephone 420 is located near the workstation 400 and is intended for the use of the operator of the workstation 400. The telephone
5 420 is connected to the PSTN 200 via a Private Branch Exchange (PBX) 430.

For example, the workstation 400, the LAN 410, the telephone 420 and the PBX 430 may be located at the
10 operator's place of business. The operator may use the workstation 400 to obtain access to a data network in the form of the Internet 300 via the LAN 410. An Internet gateway 304 links the LAN 410 to the Internet 300 for this purpose. The memory 402 of the workstation 400 contains
15 "browser software" (for example Netscape™), which the operator may use to "navigate" among various data services provided via the Internet 300.

A data service node 500 is connected to the
20 Internet 300 to provide data services. The data service node 500 comprises an Internet interface 502, a processor 504, and a memory 506. The memory 506 stores instructions to be executed by the processor 504 and data to be used by the processor 504 in executing those instructions. In
25 particular, the memory 506 contains HyperText Transfer Protocol (HTTP) server software which enables the data service node 500 to forward World Wide Web home pages to the workstations 100, 400 over the Internet 300 upon receipt of messages from the workstations requesting those
30 home pages.

As is conventional in the operation of the World Wide Web, the data service node forwards HTML instructions to the workstation 100 together with the data required for
35 display of the home pages. The HTML instructions are stored in the memory 102 and are executed by the workstation 100 when command icons displayed on the home

pages are selected by the operator of the workstation 100 to send a message to the data service node 500, and the data service node 500 responds to the message to execute the command corresponding to the icon. Some of the command
5 icons may include data entry fields and textual instructions for filling of the data entry fields by the operator of the workstation 100. When such command icons are selected at the workstation 100, downloaded HTML instructions are executed at the workstation 100 to send a
10 message incorporating the content of the data entry field to the data service node 500.

HTTP instructions stored in the memory 506 of the data service node 500 enable the data service node 500 to
15 receive messages from the workstation 100 and to execute commands corresponding to those messages. The memory 506 may store additional software applications in languages other than HTTP. These applications may be executed in response to receipt of particular messages by the HTTP
20 software.

According to an embodiment of the invention, the memory 506 of the data service node 500 contains HTTP instructions which enable the processor 504 to display
25 voice call request icons on home pages forwarded to the workstation 100 from the data service node 500. The voice call request icons incorporate a data entry field and text instructing the operator of the workstation 100 displaying the home pages containing the icons to enter in the data
30 entry field the directory number of the voice terminal (for example telephone 110) on which the operator wishes to receive a voice call, and then to select the icon in order to request a voice call. The memory 506 contains further HTTP instructions which enable the data service node 500 to
35 receive messages corresponding to voice call request commands from the workstation 100 and call processing applications (described in more detail below) which are

executed by the data service node 500 on receipt of messages corresponding to voice call request commands.

According to the embodiment of the invention the
5 data service node 500 further comprises a PBX interface 508
which connects the processor 504 to a PBX 510. The PBX
interface 508 enables the processor 504 to communicate with
the PBX 510 using standard Advanced Intelligent Network
(AIN) protocols to control call processing by the PBX 510
10 and to obtain call status information from the PBX 510.
The PBX 510 connects second voice terminals in the form of
telephones 520, 530 to the PSTN 200, and includes Automatic
Call Distribution (ACD) software for monitoring the status
of the telephones 520, 530 and for distributing incoming
15 calls to the telephones 520, 530.

Another data service node 600 is also connected
to the Internet 300 to provide data services. Like the
data service node 500, the data service node 600 comprises
20 an Internet interface 602, a processor 604, a memory 606,
and a PBX interface 608 connected to a PBX 610 serving
telephones 620, 630. Each element of the data service node
600 performs the same functions as the corresponding
element of the data service node 500.

25
In one application of the interconnected networks
described above, the operator of workstation 100 connects
the workstation 100 to the Internet 300 via the PSTN 200
using conventional Internet access procedures. Using the
30 browser software stored in the workstation 100, the
operator uses conventional browsing procedures to locate
World Wide Web home pages and to display those home pages
on the workstation 100.

35 In this application example, the operator locates
and displays a home page provided by data service node 500.
The home page content advertises goods or services marketed

by a particular business. The displayed home page includes voice call request icons as described above, and HTML instructions corresponding to the voice call request icons are downloaded from the data service node 500 to the
5 workstation 100 together with the data needed to display the home page.

The operator of the workstation 100 wants more information than is displayed on the home page and decides
10 to execute the voice call request command to obtain the desired information. The operator enters the directory number of the telephone 110 in the data entry field as instructed by the text of the voice call request icon and selects the icon. The workstation 100 executes HTML
15 instructions corresponding to the voice call request icon to send to the data service node 500 a call request message incorporating the entered directory number.

The data service node 500 receives and interprets
20 the message using HTTP software which triggers application software to select a second voice terminal identifier in the form of an extension number for one of the telephones 520, 530 connected to the PBX. The directory number and the selected extension number are forwarded to the call
25 processing application which formulates a call origination request containing the directory number and the extension number, and sends the call origination request to the PBX 510 via the PBX interface 508.

30 The PBX 510 processes the call origination request to originate a first voice call from the PBX 510 to the telephone 520 associated with the data service node 500. When the first voice call is answered at the telephone 520, the PBX 510 originates a second voice call
35 from the PBX 510 to the telephone 110 associated with the workstation 100. When the second voice call is answered at

the telephone 110, the PBX 510 connects the two calls to connect the telephone 110 to the telephone 520.

The call is connected via the PSTN, so that an
5 agent of the advertising business using a telephone 520 at the selected extension number can talk directly to the operator of the workstation 100 using the telephone 110 at the specified directory number. Because the call is
10 originated by the advertising business, the advertising business is billed by the PSTN provider for any telecommunications charges resulting from the voice call.

The information flows required to process the voice call request are summarized in Figure 2.

15

In the same way, the operator of workstation 400 (see Figure 1) can connect to the Internet 300 in a conventional manner, locate and display the home page provided by the data service node 500, and select a voice
20 call request icon to request a return voice call, and the data service node 500 and the PBX 510 will process the voice call request to connect the telephone 520 associated with the data service node to the telephone 420 associated with the workstation 400.

25

The HTTP instructions stored in the data service node 500 may be such as to provide the home pages with multiple voice call request icons, each corresponding to information of a different type. In this case, the
30 application software instructions which are executed to formulate the call origination request may select from among multiple extension numbers depending on which of the voice call request icons was selected by the workstation operator. If the operator of the workstation 100 selects a
35 voice call request icon which appears in the context of information about a first product, for example, the data service node 500 may formulate a call origination request

containing the extension of the telephone 520 which is assigned to an agent who has information concerning the first product. If the operator of the workstation 100 selects a voice call request icon which appears in the context of information about a second product, the data service node 500 may formulate a call origination request containing the extension of another telephone 530 which is assigned to another agent who has information concerning the second product.

10

The call processing application of the data service node 500 may sense the busy/idle status of the telephones 520, 530 connected to the PBX 510 via the PBX interface 508 using the standard AIN protocol of the PBX interface 508. In this case, the call processing application of the data service node may maintain a queue of call origination requests for each of the telephones 520, 530 when those telephones are busy. The data service node 500 transmits the next call origination request in the queue to the PBX 510 each time the busy telephone becomes idle. The data service node 500 may display the position of the call origination request in the queue on the workstation from which the call origination request was received so that the operator knows when to expect a voice call in response to the request.

When the telephones 520, 530 are all busy, the data service node 500 may download a command menu to the workstation 100, inviting the operator of the workstation 100 to communicate via alternative means, e.g. electronic mail, voice mail or short message service. When the appropriate commands are selected from the menu at the workstation 100, downloaded HTML instructions can be executed to connect the workstation to the requested service to enable the operator of the workstation to communicate by the selected means.

- Large businesses may provide advertising home pages from geographically separated data service nodes 500, 600. In this case, the operator of the workstation 100 may access the home pages provided by a relatively remote data
- 5 service node 500 and issue a voice call request. The advertising business may prefer that the requested voice call be made by an agent who is located closer to the operator of the workstation. The HTTP software which handles incoming messages corresponding to voice call
- 10 requests may screen such messages based on the directory number contained therein, and forward some messages to another data service node 600 which is located closer to the operator of the workstation 100. The data service node 600 to which the voice call is forwarded then processes the
- 15 voice call request to originate a call from a telephone 620 to the telephone 110 at the directory number specified by the operator of the workstation. The data service node to which voice call requests are forwarded could also be selected on the basis of time of day to provide voice call
- 20 service over extended hours when local agents may not be on duty, or on the basis of monitored traffic loads to provide faster service to workstation operators requesting voice calls.
- 25 The voice call request icons placed at different locations on the pages of information displayed at the workstation 100 can correspond to different sets of HTML instructions providing different messages to the data service node 500, causing the data service node 500 to
- 30 route resulting calls to different extensions 520 of the PBX 510. Consequently, the extension 520 can be selected based on the context of the voice call request command to ensure that the agent responding to the voice call request is familiar with the information likely to be requested.
- 35 Alternatively, the different sets of HTML instructions corresponding to each voice call request icon can provide messages to the data service node 500 which cause the data

service node 500 to route the calls to the same extension 520, but with information about the context of the voice call request. The information could either be displayed at the agent's workstation or audibly announced to the agent
5 when the call is accepted at the extension 520.

The voice call request icon displayed at the workstation 100 could include data fields which could be filled by the operator of the workstation. The HTML
10 instructions executed by the workstation 100 could be such as to include the content of these fields in the message sent to the data service node 500 upon selection of the voice call request icon. The data service node could then relay the content of these fields to the agent's
15 workstation for display or to the agent's extension via text-to-speech conversion and audible announcement. For example, such data fields could include details of the information the operator of the workstation 100 wishes to obtain from the agent.
20

Figures 3 and 4 are flow charts illustrating how the processes performed by the data service node 500 as described above may be implemented as two tasks. The first task, illustrated in Figure 3, receives voice call requests
25 and voice terminal directory numbers, processes these to formulate origination requests, and inserts the origination requests into appropriate queues. The second task, illustrated in Figure 4, transfers the origination requests from the queues to the PBX to complete the requested voice
30 calls.

The embodiments described above may be modified without departing from the principles of the invention. For example, the directory number of the telephone 110 (see
35 Figure 1) may be stored in the mail profile of the browser software at the workstation 100, and the HTML instructions downloaded from the data service node 500 to the

workstation 100 for execution when the voice call request icon is selected may request the directory number from the mail profile without requiring that the operator type the directory number. In this case, the downloaded HTML

5 instructions may display the directory number obtained from the mail profile at the workstation 100 and may request that the operator of the workstation 100 confirm or modify the directory number as appropriate before transmitting the voice call request message to the data service node 500.

10

In a further refinement, the agents of the advertising business may be provided with data terminals connected to the processor 504 of the data service node 500. The HTTP software of the data service node 500 may
15 download the same information to the data terminal of the agent as is downloaded to the workstation 100 so that the agent and the operator of the workstation view the same displayed information. The data terminals of the agents may be enabled to download information from the data
20 service node 500 to the workstation 100 so that the agent can control the information displayed at the operator's workstation 100. This enables the operator requesting the voice call and the agent of the advertising business to converse with both voice and images simultaneously.

25

The call processing application of the data service node 500 may be programmed to call from the PBX 510 to the telephone 110 at the specified directory number, to provide a voice announcement indicating that the agent will
30 join the call shortly when the call is successfully answered at the telephone 110, and to connect the call through to the agent's extension 520 only when the call has been successfully answered at the telephone 110. This maximizes the efficiency of the agents, though this feature
35 should be used judiciously to avoid alienating the operator of the workstation 100.

Alternatively, the PBX 510 could place the call to the agent's extension 520 first, and place the call to the telephone 110 only when the agent has accepted the call. This maximizes the convenience of the potential
5 customer, but reduces the efficiency of the agent.

The PBX interface 508 could communicate with the PBX 510 using protocols other than AIN. For example, other standardized protocols such as the Computer Telephony
10 Interface (CTI) or the Small Computer Application Interface (SCAI) could be used, or proprietary protocols, such as the Meridian Link™ protocol of Northern Telecom™, could be used. The data service node 500 and the PBX could be integrated on a single computer platform, or the data
15 service node 500 could communicate with telecommunications switches of the PSTN 200 using standard AIN protocols. Voice calls could be routed from the PBX 510 via the PSTN 200 to voice terminals at remote locations, for example to agents' homes if agents are "telecommuting", or to other
20 locations of the advertiser's business.

These and other modifications are within the scope of the invention as defined by the claims below.

25 Figure 5 is a block schematic diagram of interconnected telecommunications networks which implement another embodiment of the invention. This architecture may be used, for example, to implement an Internet "Yellow Pages" service.

30 The interconnected networks of Figure 5 are essentially as illustrated in Figure 1, except that the data service node 500 is connected to a telecommunications switch 540 which may not be a PBX. The telecommunications
35 switch 540 is connected to the PSTN 200 and may be integrated with the data service node 500.

In one application of the interconnected networks of Figure 5, the operator of workstation 100 locates and displays World Wide Web "Yellow Pages" provided by the data service node 500. The operator of the workstation 100
5 locates the listing which interests him and executes the voice call request command associated with that listing. The workstation 100 executes HTML instructions corresponding to the voice call command to send the data service node 500 a call request message incorporating the
10 directory number of his telephone 110.

The HTTP software of the data service node 500 receives and interprets the message and triggers application software running on the data service node 500
15 to select a directory number associated with the listing corresponding to the voice call command associated with the listing selected by the operator of the workstation 100. The directory number is forwarded to call processing software which formulates and sends a call origination
20 message containing the directory number of the telephone 110 and the directory number associated with the selected listing to the telecommunications switch 540.

The telecommunications switch 540 processes the
25 call origination request to originate a voice call from the telecommunications switch 540 via the PSTN 200 to a telephone 120 corresponding to the directory number associated with the selected listing. The telecommunications switch 540 also originates a voice call
30 from the telecommunications switch 540 to the telephone 110 of the person requesting the call. The telecommunications switch 540 connects the two calls to connect the telephone 110 to the telephone 120 via the PSTN 200 and the switch 540. Because the person requesting the call selects the
35 listing on a displayed screen of information, dialling errors are avoided. Moreover, because the telecommunications switch 540 is connected to the

telephones 120 of businesses having listings in the "Yellow Pages" via the PSTN 200, the data service node 500 can provide call closure services to businesses which are geographically dispersed.

5

In another application of the network architecture of Figure 5, the data service node provides an international calling service. The operator of workstation 100, located for example in Japan, accesses and displays a World Wide Web page of a US service provider implemented on the data service node 500. The operator of the workstation 100 executes a voice call request command which specifies the directory number of a telephone 120 in the US to which he wishes to place a call. The workstation 100 executes HTML instructions corresponding to the voice call command to send the data service node 500 a call request message incorporating the directory number of his telephone 110 and the directory number of the telephone 120 he wishes to call. The call request message also includes any authorization codes needed to ensure that the service is restricted to valid subscribers, and any billing codes (e.g. calling card numbers) needed to bill the cost of the call back to the caller.

25 The data service node 500 receives the message, and formulates and sends a call origination message containing the directory number of the telephone 110 and the directory number of the telephone 120 to the telecommunications switch 540.

30

The telecommunications switch 540 processes the call origination request to originate a voice call from the telecommunications switch 540 via the PSTN 200 to the telephone 120. The telecommunications switch 540 also originates a voice call from the telecommunications switch 540 to the telephone 110. The telecommunications switch 540 connects the two calls to connect the telephone 110 to

the telephone 120 via the PSTN 200 and the switch 540. Because the call is connected from the US to Japan, the person requesting the call can be billed at rates based on the relatively lower tariffs for placing international
5 calls from the US. Moreover, the person requesting the call is not required to place a voice call from Japan in order to set up the desired call from the US.

The architecture shown in Figure 5 requires that
10 each data service node 500 have associated telecommunications switching functionality 540. Because this functionality is relatively expensive, this requirement may inhibit smaller service providers from entering the marketplace. Figure 6 is a block schematic
15 diagram illustrating an alternative architecture which separates the telecommunications switching functionality from the functionality which provides data to workstation operators via the Internet 300 so that the telecommunications switching functionality can be provided
20 to data service providers as needed by another service provider. According to Figure 6, the data service node 500 is connected to another data service node 700 via the Internet, and the other data service node 700 is connected to a telecommunications switch 710 which is connected to
25 the PSTN 200.

In an application of the architecture of Figure 6, the operator of workstation 100 locates and displays World Wide Web pages provided by the data service node 500.
30 The operator of the workstation 100 executes a voice call request command on the page of displayed information to request a voice connection. The workstation 100 executes HTML instructions corresponding to the voice call command to send the data service node 500 a call request message
35 incorporating the directory number of his telephone 110.

The data service node 500 receives the message and selects a directory number associated with the particular voice call request command executed by the operator of the workstation 100 (unless the voice call request command already includes both directory numbers).
5 The data service node 500 formulates and sends a call origination message containing both directory numbers and a billing code to the other data service node 700 via the Internet 300.

10

The other data service node 700 verifies that the billing code is valid and forwards the call origination request to the telecommunications switch 710. The telecommunications switch 710 processes the call
15 origination request to originate a voice call from the telecommunications switch 710 via the PSTN 200 to the telephone 120. The telecommunications switch 710 also originates a voice call from the telecommunications switch 710 to the telephone 110. The telecommunications switch
20 710 connects the two calls to connect the telephone 110 to the telephone 120 via the PSTN 200 and the switch 710. Once the call is complete, the telecommunications switch 710 sends a call detail record back to the service node 700, and the service node 700 sends billing information to
25 the data service node 500 so that the cost of the call can be billed, either to the operator of the workstation 100 or to the business for which the service is provided on the service node 500, depending on the nature of the service. (For example, international callback services and the like
30 would be billed to the caller, while yellow pages services would be billed to the advertiser.)

The information flows discussed above are summarized in Figure 7. In Figure 7, the Voice Call
35 Request 2 may contain the voice terminal identifier of the called telephone 120 in addition to the voice terminal identifier of the calling telephone 110 for services such

as international callback. For such services, the Voice Call Request 2 could also contain authentication and billing codes used to screen use of the service and to bill the user of the service. The Voice Call Request 2 could
5 also contain text or voice messages to be forwarded upon connection to the telephone 120.

The Call Origination Request 3 will contain the voice terminal identifiers for both the calling telephone
10 110 and the called telephone 120, as well as any information needed to identify the data service node 500 or workstation 100 for authentication and billing purposes. The Call Origination Request 3 could also include text or voice messages to be forwarded upon connection to either of
15 the telephones 110, 120, or the addresses of standard text or voice messages which are stored at the service node 700, the telecommunications switch 710, or peripherals connected to the switch 710. The Call Origination Request 3 could further include sets of executable instructions to be
20 executed by the service node 700 in processing the Call Origination Request 3.

The forwarded Call Origination Request 4 will contain the voice terminal identifiers for both the calling
25 telephone 110 and the called telephone 120 and a call identifier. The forwarded Call Origination Request 4 may also include text messages to be converted to speech at the telecommunications switch 710 (or one its peripherals) and played upon connection of the telephones 110, 120, voice
30 messages to be played upon connection of the telephones 110, 120, or the addresses of standard voice messages which are stored at the telecommunications switch 710 or one of its peripherals.

35 The Call Processing Messages 5 are conventional call processing messages as are required to establish the

connections from the switch 710 to the telephones 110, 120 and to link the connections at the switch 710.

The Call Detail Record 6 includes all information
5 needed to bill the call, including the call identifier, identifiers of the telephones 110, 120, call duration and time, etc. The service node 700 (or a billing peripheral) processes the Call Detail Record 6 to formulate the Billing Information 7, which is forwarded to the data service node
10 500.

Further information flows may be added to those shown in Figure 7. For example, if the data service node 500 will not provide the requested service, an appropriate
15 message may be sent back to the workstation 100. Similarly, if the service node 700 will not provide the requested service, appropriate messages may be sent from the service node 700 to the data service node 500 and from the data service node 500 to the workstation 100. The
20 service node 700 may also send an appropriate message to the data service node 500 when the call is being placed, and the data service node 500 may then send an appropriate message to the workstation 100. The data service node 500 may forward some of the billing data to the workstation 100
25 for some services.

In the architecture of Figure 6, the other data service node 700 and the telecommunications switch 710 can provide call completion services to several data service
30 nodes 500 which provide data services including voice call request icons. Each data service node 500 may provide a different data service.

Call completion services could also be provided
35 by Inter-Exchange Carriers (IECs) using service node functionality and telecommunications switching functionality present in the PSTN 200. Figure 8 is a block

schematic diagram showing an architecture in which a service node 210 of the PSTN 200 is connected to plural telecommunications switches 220 of the PSTN 200.

- 5 In an application of the architecture of Figure 8, the operator of workstation 100 locates and displays World Wide Web pages provided by the data service node 500. The operator of the workstation 100 executes a voice call request command on the page of displayed information to
- 10 request a voice connection. The workstation 100 executes HTML instructions corresponding to the voice call command to send the data service node 500 a call request message incorporating the directory number of his telephone 110.
- 15 The data service node 500 receives the message and selects a directory number associated with the particular voice call request command executed by the operator of the workstation 100 (unless the voice call request command already includes both directory numbers).
- 20 The data service node 500 formulates and sends a call origination message containing both directory numbers and a billing code to the PSTN service node 210 via the Internet 300.
- 25 The PSTN service node 210 verifies that the billing code is valid and forwards the call origination request to one of the telecommunications switches 220, the switch being selected according to the directory numbers of the telephones 110, 120 using routing tables at the service
- 30 node 210. The selected telecommunications switch 220 processes the call origination request to originate a voice call from the selected telecommunications switch 220 via the PSTN 200 to the telephone 120. The selected telecommunications switch 220 also originates a voice call
- 35 from the selected telecommunications switch 220 to the telephone 110. The selected telecommunications switch 220 connects the two calls to connect the telephone 110 to the

telephone 120 via the PSTN 200 and the selected switch 220. Once the call is complete, the data service node 210 sends billing information to the data service node 500 so that the cost of the call can be billed back to the calling party.

In the architectures of Figures 1, 5 and 6, all calls which are requested of the data service node 500 are routed through a single telecommunications switch 510, 540, 710 which appears at a single location in the PSTN 200. In the architecture of Figure 8, because the PSTN service node 210 is connected to and can select from among multiple geographically distributed telecommunications switches 220 of the PSTN 200 for call completion, the requested call can generally be routed more efficiently and at lower cost than in the architectures of Figures 1, 5 and 6.

The architecture of Figure 8 can be modified by providing multiple service nodes in the PSTN 200. Figure 9 illustrates an architecture in which a separate service node 230, 250, 270 is provided for each telecommunications switch 240, 260, 280. Each data service node 500 can be programmed to send call origination requests to a respective one of the service nodes 230, 250, 270 of the PSTN to distribute the processing load across multiple service nodes. Each data service node 500 could be programmed with a prioritized list of service nodes 230, 250, 270 so that it can route call origination traffic to alternative service nodes if its preferred service node is unavailable.

Several alternative embodiments of the invention are described above. These and other variations are within the scope of the invention and are intended to be within the scope of the claims below.

WE CLAIM:

1. A method for originating a voice call between a first voice terminal (110, 420) to be used by a voice call requestor and a second voice terminal (120, 510, 520, 530, 610, 620, 630) to be used by a party to which the call requestor wishes to be connected, the method comprising:
 - 5 sending a voice call request from a data terminal (100, 400) to a data service node (500, 600);
 - 10 transmitting a call origination request from the data service node to a telecommunications switch (510, 610, 710);
 - originating at the telecommunications switch one call from the telecommunications switch to the second voice terminal and another call from the telecommunications switch
 - 15 to the first voice terminal; and
 - connecting the one call to the other call at the telecommunications switch to connect the first voice terminal to the second voice terminal
 - characterized in that:
 - 20 the voice call request identifies the first voice terminal; and
 - the call origination request identifies the first and second voice terminals.
- 25 2. A method as defined in claim 1, wherein the data service node displays a voice call request icon at the data terminal, the voice call request comprising a data entry field for entry of the first voice terminal identifier.
- 30 3. A method as defined in claim 1, wherein:
 - the data service node displays a voice call request icon at the data terminal; and
 - the data terminal is operable in response to selection of the voice call request icon to read the first voice
 - 35 terminal identifier from a mail profile of the data terminal and to transmit the first voice terminal identifier to the data service node via the data network.

4. A method as defined in claim 1, further comprising:

maintaining a queue of call origination requests at the
5 data service node when the second voice terminal is busy;
and

transmitting from the data service node to the
telecommunications switch a next call origination request in
the queue each time the second voice terminal becomes idle.
10

5. A method as defined in claim 1, wherein a first
data service node forwards the voice call request to a
second data service node.

15 6. A method as defined in claim 5, wherein the first
data service node selects the second data service node based
on the first voice terminal identifier.

7. A method as defined in claim 6, wherein second
20 data node transmits the call origination request to the
telecommunications switch.

8. A data service node (500, 600) for connection to a
data network (300) to provide a data service, the data
25 service node comprising:

means for receiving from a data terminal (100, 400)
connected to the data network a voice call request; and
means for transmitting to a telecommunications switch a
call origination request;

30 characterized in that:

the means for receiving a voice call request is
operable to read a first voice terminal identifier in the
voice call request, the first voice terminal identifier
identifying a first voice terminal (110, 420) to be used by
35 a voice call requestor; and

the means for transmitting a call origination request
is operable to encode the first voice terminal identifier

and a second voice terminal identifier in the call origination request, the second voice terminal identifier identifying a second voice terminal (120, 510, 520, 530, 610, 620, 630) to be used by a party to which the call requestor wishes to be connected.

9. A data service node as defined in claim 8, further comprising:

- means for detecting when the second voice terminal is busy and when the second voice terminal is idle;
- means for maintaining a queue of call origination requests when the second voice terminal is busy; and
- means for selecting the next call origination request in the queue for transmission to the telecommunications switch when the second voice terminal is idle.

10. A data service node as defined in claim 9, further comprising means for displaying at the data terminal associated with the first voice terminal the position in the queue of the origination request containing the voice terminal identifier.

11. A data service system, comprising:

- a data service node (500, 600) for connection to a data network (300) to provide a data service, the data service node comprising:

- means for receiving from a data terminal (100, 400) connected to the data network a voice call request; and
- means for transmitting to a telecommunications switch a call origination request; and
- a telecommunications switch (510, 610, 710) connected to the data service node, the telecommunications switch comprising:

- means for originating one call from the telecommunications switch to a first voice terminal (110, 420) to be used by a voice call requestor and

another call from the telecommunications switch to a second voice terminal (120, 510, 520, 530, 610, 620, 630) to be used by a party to which the call requestor wishes to be connected; and

- 5 means for connecting the one call to the other call to connect the first voice terminal to the second voice terminal characterized in that:

the means for receiving a voice call request is
10 operable to read a first voice terminal identifier in the voice call request, the first voice terminal identifier identifying the first voice terminal; and

the means for transmitting a call origination request is operable to encode the first voice terminal identifier
15 and a second voice terminal identifier in the call origination request, the second voice terminal identifier identifying the second voice terminal.

12. A data service system as defined in claim 11,
20 comprising a plurality of data service nodes and a plurality of telecommunications switches, each data service node being connected to a respective telecommunications switch and being operable to forward voice call requests to others of the data service nodes.

25

13. A data service node as defined in claim 12, wherein each data service node is operable in response to the first voice terminal identifiers to select other data service nodes for forwarding voice call requests.

30

14. A method for originating a voice call between a first voice terminal and a second voice terminal, the method including:

- 5 sending a voice call request from a data terminal to a data service node, the voice call request identifying the first voice terminal;
- transmitting a call origination request from the data service node to a telecommunications switch, the call origination request identifying the first and second voice terminals;
- 10 in response to the call origination request received from the data service node, originating at the telecommunications switch one call from the telecommunications switch to the second voice terminal and another call from the telecommunications switch to the first voice terminal; and
- 15 connecting the one call to the other call at the telecommunications switch to connect the first voice terminal to the second voice terminal.

20 15. A data service node for connection to a data network to provide a data service, the data service node including:

- means for receiving from a data terminal
- 25 connected to the data network a voice call request including a first voice terminal identifier, said means including:
- means for displaying a command menu at the data terminal, the command menu including a voice call request command; and
- 30 means for detecting selection of the voice call request command at the data terminal; and
- means for transmitting to a telecommunications switch a call origination request including the first voice terminal identifier and a second voice terminal identifier.
- 35

16. A data service system, including:

a data service node for connection to a data network to provide a data service, the data service node including:

- means for receiving from a data terminal
5 connected to the data network a voice call request including a first voice terminal identifier; and
means for transmitting to a telecommunications switch a call origination request including the first voice terminal identifier and a second voice terminal identifier;
10 and a telecommunications switch connected to the data service node, the telecommunications switch including:

- means for originating one call from the telecommunications switch to the second voice terminal and another call from the telecommunications switch to the
15 first voice terminal in response to the call origination request received from the data service node; and
means for connecting the one call to the other call to connect the first voice terminal to the second voice terminal.

- 20
17. A method for originating a voice call between a first voice terminal to be used by a voice call requestor and a second voice terminal to be used by a party to which the call requestor wishes to be connected, the method
25 including:

- sending a voice call request from a data terminal to a data service node, the voice call request identifying the first voice terminal;
- transmitting a call origination request from the
30 data service node to a telecommunications switch, the call origination request identifying the first and second voice terminals;

- in response to the call origination request received from the data service node, originating at the
35 telecommunications switch one call from the telecommunications switch to the second voice terminal and another call from the telecommunications switch to the

first voice terminal; and

connecting the one call to the other call at the telecommunications switch to connect the first voice terminal to the second voice terminal.

5

18. A data service node for connection to a data network to provide a data service, the data service node including:

means for receiving from a data terminal
10 connected to the data network a voice call request including a first voice terminal identifier, the first voice terminal identifier identifying a first voice terminal to be used by a voice call requestor, said means including:

15 means for displaying a command menu at the data terminal, the command menu including a voice call request command; and

means for detecting selection of the voice call request command at the data terminal; and

20 means for transmitting to a telecommunications switch a call origination request including the first voice terminal identifier and a second voice terminal identifier, the second voice terminal identifier identifying a second voice terminal to be used by a party to which the call
25 requestor wishes to be connected.

19. A data service system, including:

a data service node for connection to a data network to provide a data service and a telecommunication
30 switch connected to the data service node, the data service node including:

means for receiving from a data terminal
connected to the data network a voice call request
including a first voice terminal identifier, the first
35 voice terminal identifier identifying a first voice terminal to be used by a voice call requestor, and
means for transmitting to the telecommunications

- switch a call origination request including the first voice terminal identifier and a second voice terminal identifier, the second voice terminal identifier identifying a second voice terminal to be used by a party to which the call
- 5 requestor wishes to be connected; and
- the telecommunications switch including:
- means for originating one call from the telecommunications switch to the second voice terminal and another call from the telecommunications switch to the
- 10 first voice terminal in response to the call origination request received from the data service node, and
- means for connecting the one call to the other call to connect the first voice terminal to the second voice terminal.

15

Dated this 23rd day of October 1998

NORTHERN TELECOM LIMITED

By their Patent Attorneys

GRIFFITH HACK

- 20 Fellows Institute of Patent Attorneys of Australia

89488/98

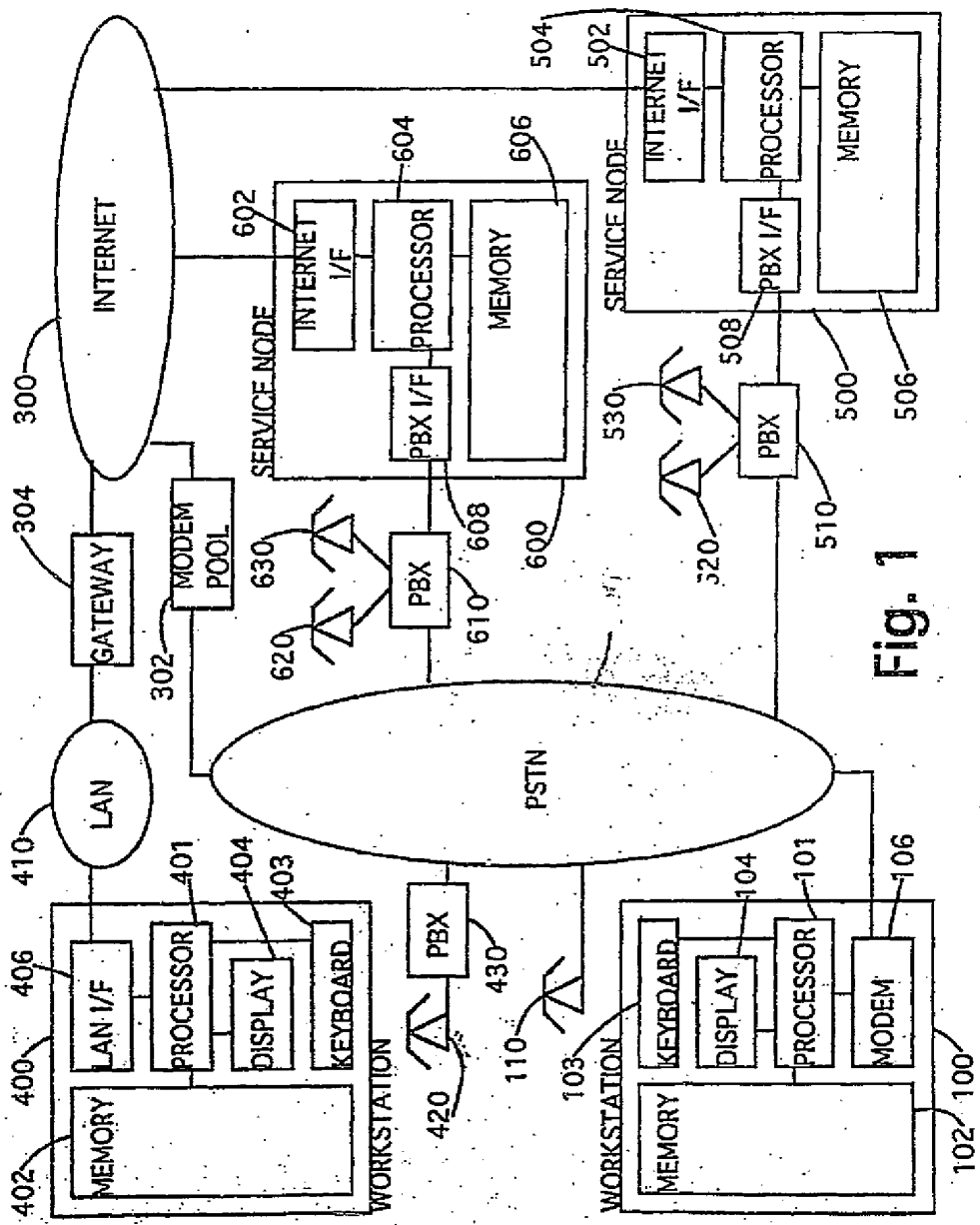


Fig. 1

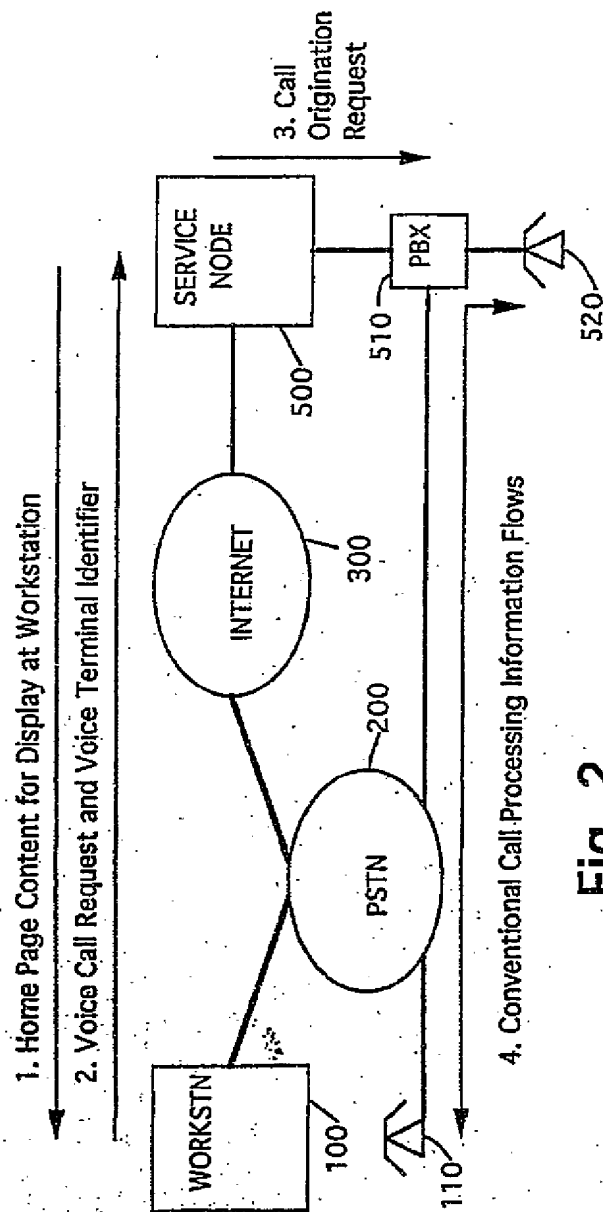


Fig. 2

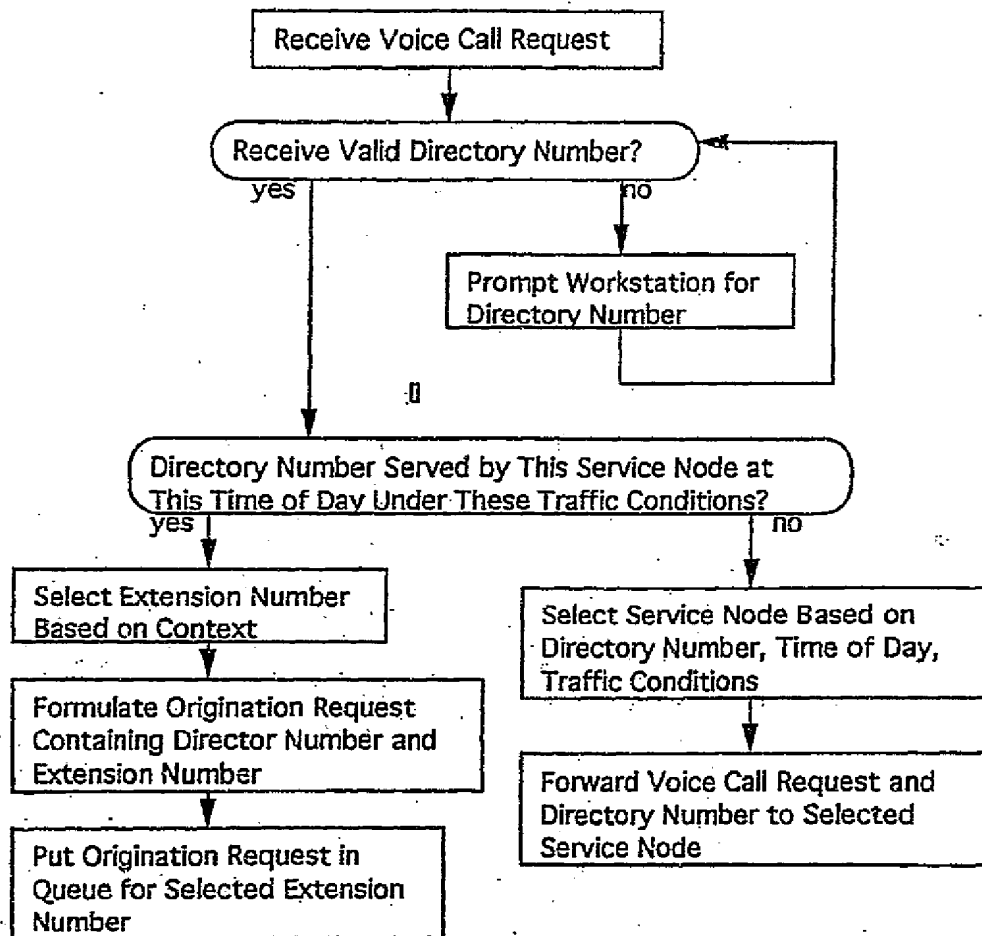


Fig. 3

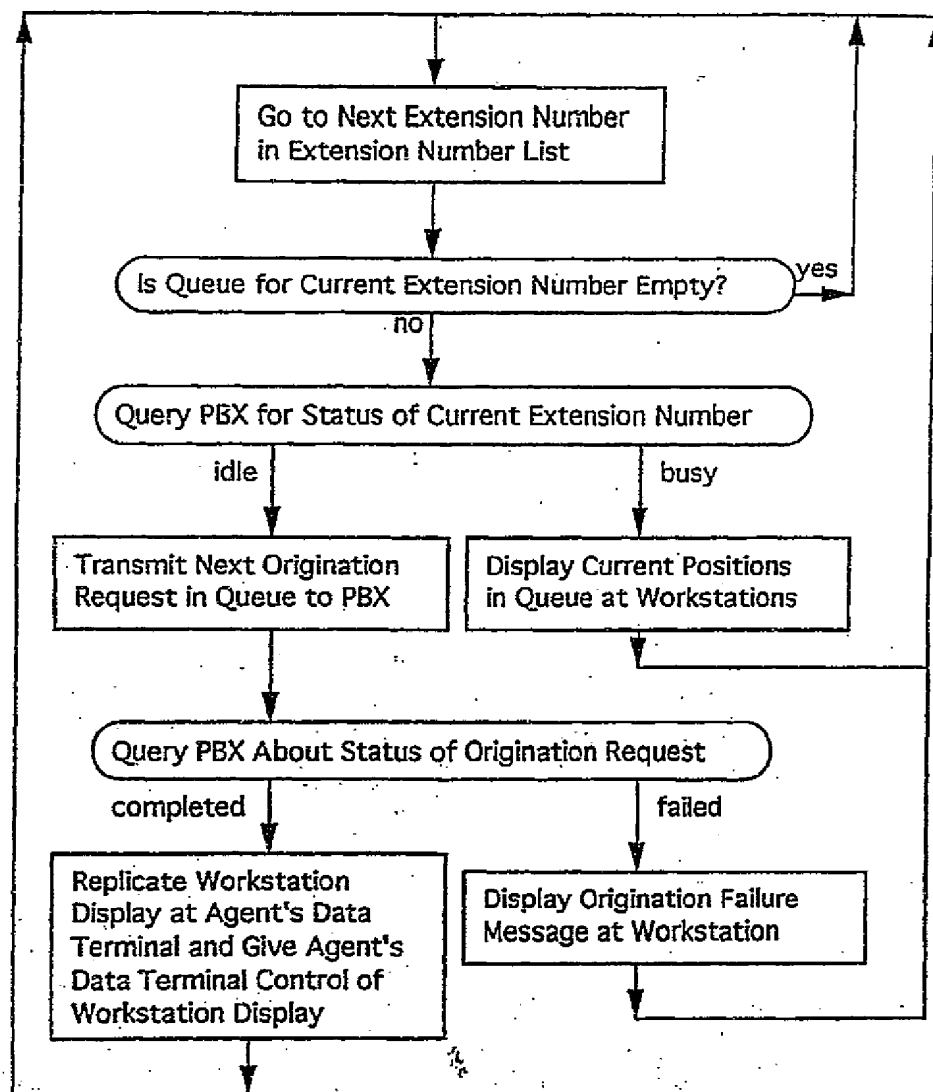


Fig. 4

5/9

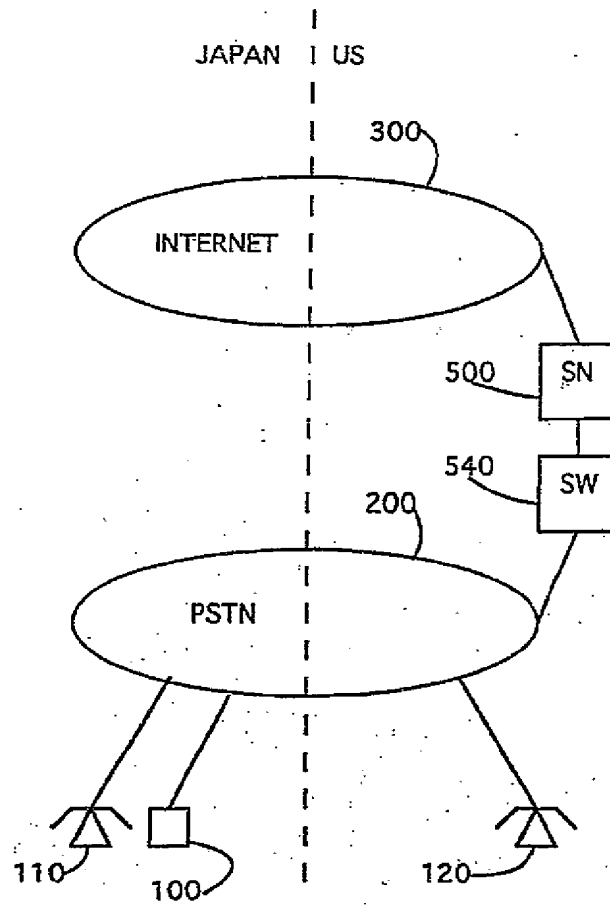


Fig. 5

6/9

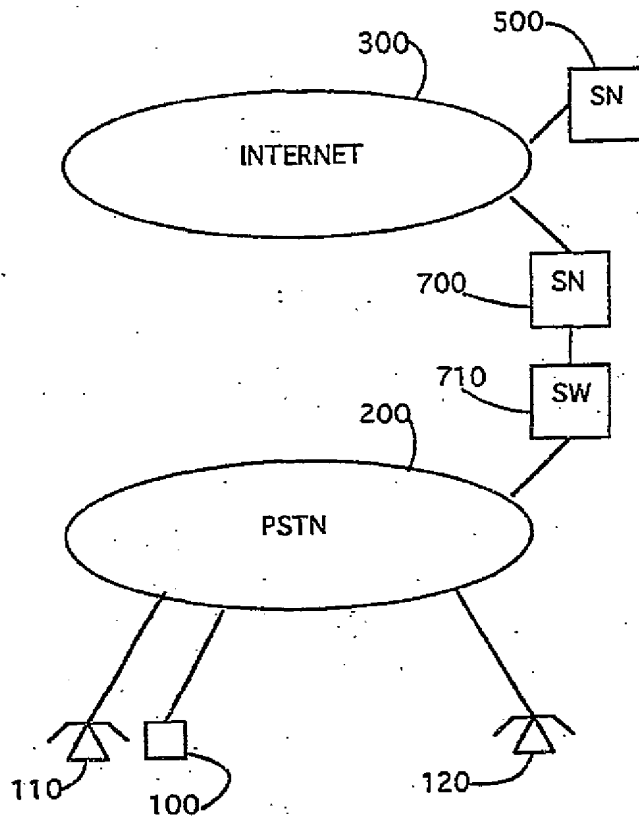


Fig. 6

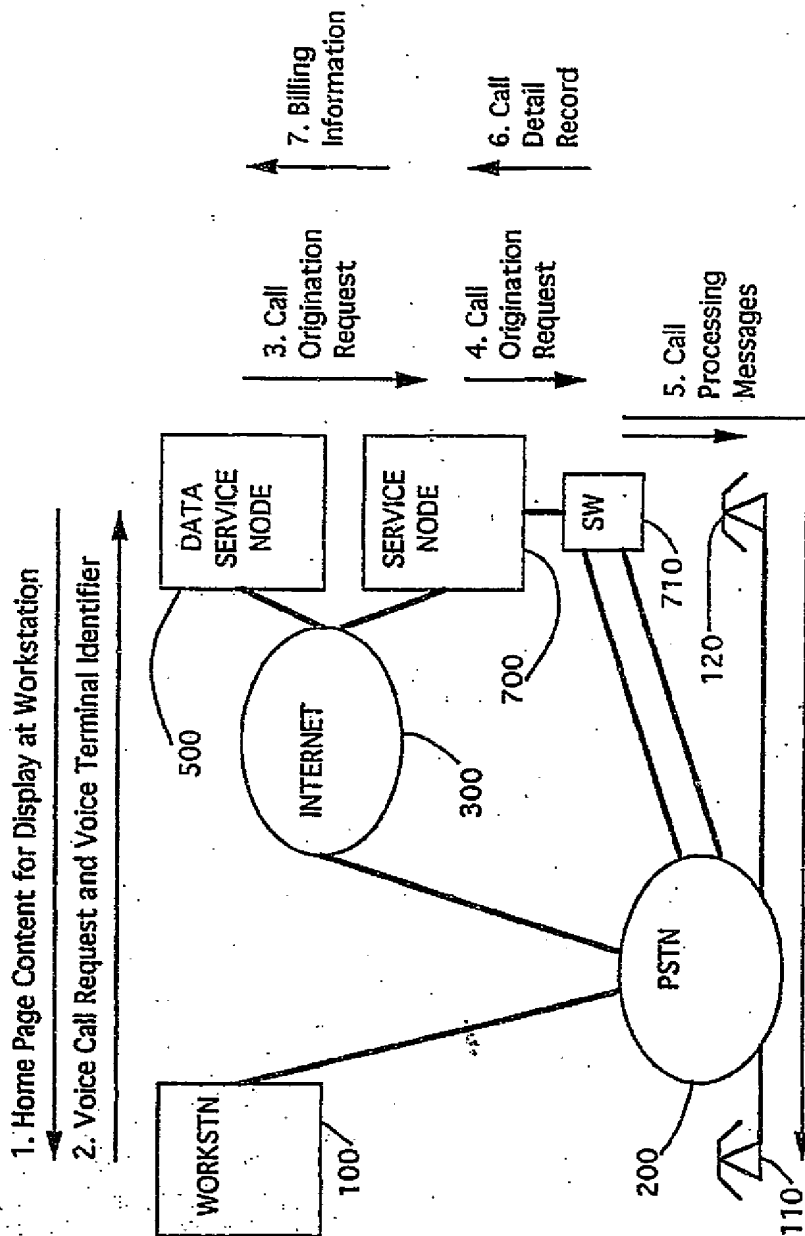


Fig. 7

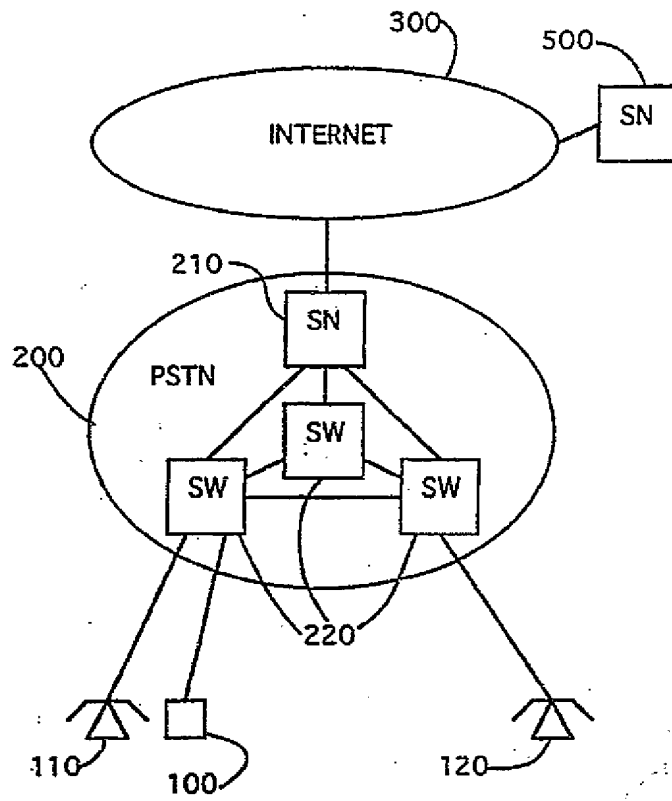


Fig. 8

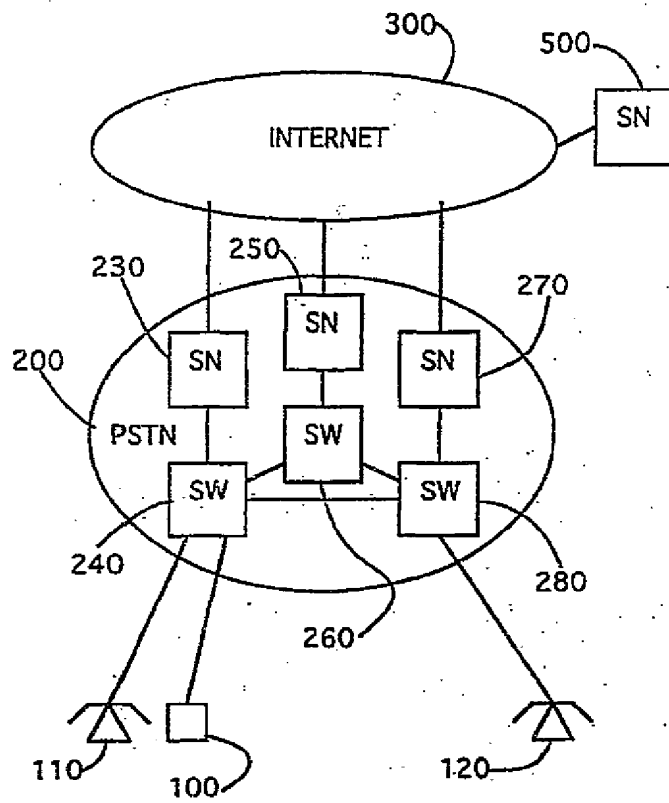


Fig. 9